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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

NGUYEN, HA T

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 09/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/866,421

Applicant(s)

YAMAHA, TAKAHISA

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 July 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14, 15, 19-26, and 28-33 is/are rejected.
- 7) ☒ Claim(s) 16-18 and 27 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s): _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Notice to applicant

1. Applicant's Amendment and Response to the Office Action mailed 1-30-02 has been entered and made of record (Paper No. 10).

Response to Amendment

2. In view of applicant's amendment to the claims, the rejection of claims 14-21 and 24-32 under 35 U.S.C. 112 second paragraph, has been withdrawn.

Applicant's arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicant argued that the feature showed in Fig. 23A of Sato (US Patent 5739587) corresponding to the limitation: the top most bonding pad is formed on a conductive pad, as claimed in the independent claims 23 and 24, is not applicable for a multilayer structure as in Applicant's invention. The examiner disagrees, even though Sato discloses there are problems associated with Fig. 23A in the multilayer structures as shown in Fig. 26 where many bonding pads contacting one another, nowhere Sato discloses that the feature of Fig. 23A when used in the structure of Fig. 11 with only the top conductor pad connected to a bonding pad can cause problem, on the contrary Table 1 shows that the connection showed in Fig. 23A gives the highest strength for bonding. Even though Sato's invention, as shown in Fig. 23C, provide enhanced bondability, Table 1 shows that the bondability achieved is not as good as that of the case shown in Fig. 23A. Combining the advantages of Figs. 23A and Sato's invention for a multilayer structure would avoid the problem of Fig. 26 for the multilayer structure. Therefore the rejection is proper and the combined teaching of Sato and Shiue et al. (US Patent 5923088 "Shiue") discloses or makes obvious all the limitations of claims 14, 15, 19-26, and 28-33.

Applicant is referred to the modified ground of rejection given below.

Claim Objections

3. Claims 20 and 24-33 are objected to because of the following informalities: in claims 20 and 24, last line and line 12, substitution of "TiN layer" with "--TiN layers--" and "though" with --

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through-- and in claim 33, line 2, after "(c)", insertion of --(1)-- are suggested for correctness .
Appropriate correction is required.

Claims 25-33 variously depend from claim 24, they are objected for the same reason.

Claim Rejections - 35 USC § 112

4. Claims 22 and 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 22 and 33 recite the forming of different layers in lines 3-6, it is not clear where these layers are formed on.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103[®] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 14, 15, 19-26, 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato in view of Shiue.

[Claims 23 and 24] Referring to Figs. 11-19 and 23A, Sato discloses a method of manufacturing a semiconductor device, the method comprising: (a) forming an insulating film 20

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on a semiconductor substrate 10; (b) forming a first conductive pad 550 on the insulating film; (c) forming a first interlayer insulating film 540 on both the first conductive pad and the insulating film; (d) forming a plurality of first through holes in the first interlayer insulating film extending from the first conductive pad to an upper surface of the first interlayer insulating film (see Fig. 15); (e) filling the plurality of first through holes with conductive material 611-616; (f) forming a second conductive pad 530 on the first interlayer insulating film and in contact with the conductive material in the plurality of first through holes (see Figs. 15 and 16); (g) forming a second interlayer insulating film 520 on both the second conductive pad and the first interlayer insulating film; (h) forming a plurality of second through holes in the second interlayer insulating film extending from the second conductive pad to an upper surface of the second interlayer insulating film (see Fig. 15); (i) filling the plurality of second through holes formed in the second interlayer insulating film with conductive material 601-606 (see Figs. 15 and 16); (j) forming a third conductive pad 510 on the second interlayer insulating film and in contact with the conductive material in the second through holes formed in the second interlayer insulating film; (k) forming a third interlayer insulating film 500 on both the third conductive pad and the second interlayer insulating film; (l) forming a through hole through the third interlayer insulating film; and (m) forming a bonding pad on the third conductive pad in the through hole in the third interlayer insulating film (see Fig. 23A); [Note that the first level corresponds to the base level of claim 24, the second level corresponds to an intermediate level, and the third level correspond to the upper level of claim 24];

[Claims 14 and 25] (d) forming a passivation film 9400 on the insulating film of the upper layer, the passivation film exposing the bonding pad (see Fig. 23A);

[Claims 19 and 30] wherein the step (e) or (b)(4) comprises: forming Ti films 4000 covering an inner surface of the through holes in the insulating film of the base layer (see Fig. 16); forming TiN layers 4100 on the Ti films; and forming W layers 5000 on the TiN layers. But it does not disclose expressly that the through hole through the third interlayer insulating film is substantially the same size as the third conductive pad. However, it is well known in the art because Shiue discloses this feature (See Fig. 3). A person of ordinary skill is motivated to modify Sato with Shiue to obtain better contact between the bonding wire (test fixture).

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[Claims 15 and 26] the combined teaching discloses substantially the limitations of claims 15 and 26. But it does not disclose that the passivation film is formed by forming a silicon oxide film and a silicon nitride film. However, the examiner takes Official Notice that it is well known in the art that a composite layer of silicon oxide and silicon nitride is used as passivation layer to obtain resistance against moisture and scratch.

[Claims 20 and 31] wherein the step (e) or (b)(4) comprises: forming Ti films covering an inner surface of the through holes in the insulating film of the base layer; forming TiN layers on the Ti films; and forming W layers on the TiN layer. argument similar to the argument for the rejection of claims 19 and 30. But it does not disclose the use of sputtering to deposit Ti and TiN. However sputtering is commonly used to deposit Ti and TiN for better adhesion.

[Claims 21 and 32] wherein the step (e) or (b)(4) comprises: forming Ti covering an inner surface of the through holes in the insulating film of the base layer; forming TiN layers on the Ti films; and forming W layers on the TiN layer by blanket deposition (see fig. 16). But it does not disclose the use of CVD to deposit W. However CVD is commonly used to deposit W to obtain better step coverage.

[Claims 22 and 33] wherein the step (b) or (b)(1) of forming the conductive pad comprises: forming a Ti layer 4000a; forming an Al-Cu alloy layer 1210; forming a Ti layer 4000a, and forming a TiN layer 1212 (see Fig. 18).

Therefore, it would have been obvious to combine Sato with Shiue to obtain the invention as specified in claims 14, 15, 19-26, 28-33.

Allowable Subject Matter

7. Claims 16-18 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and overcoming the rejection under 35 U.S.C. 112, second paragraph.

Claims 16 and 27 recites the steps of: forming a silicon oxide film; coating hydrogen silsesquioxane resin on the silicon oxide film; thermally treating the hydrogen silsesquioxane to form a first ceramic silicon oxide film; and forming a thick silicon oxide film on the first silicon oxide film by plasma CVD.

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These features in combination with the other elements of the claims are neither disclosed nor suggested by the prior art of record.

Claims 17 and 18 variously depend from claim 16, they are allowed for the same reason.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Ha Nguyen

Ha Nguyen

Primary Examiner

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